

FIG.1



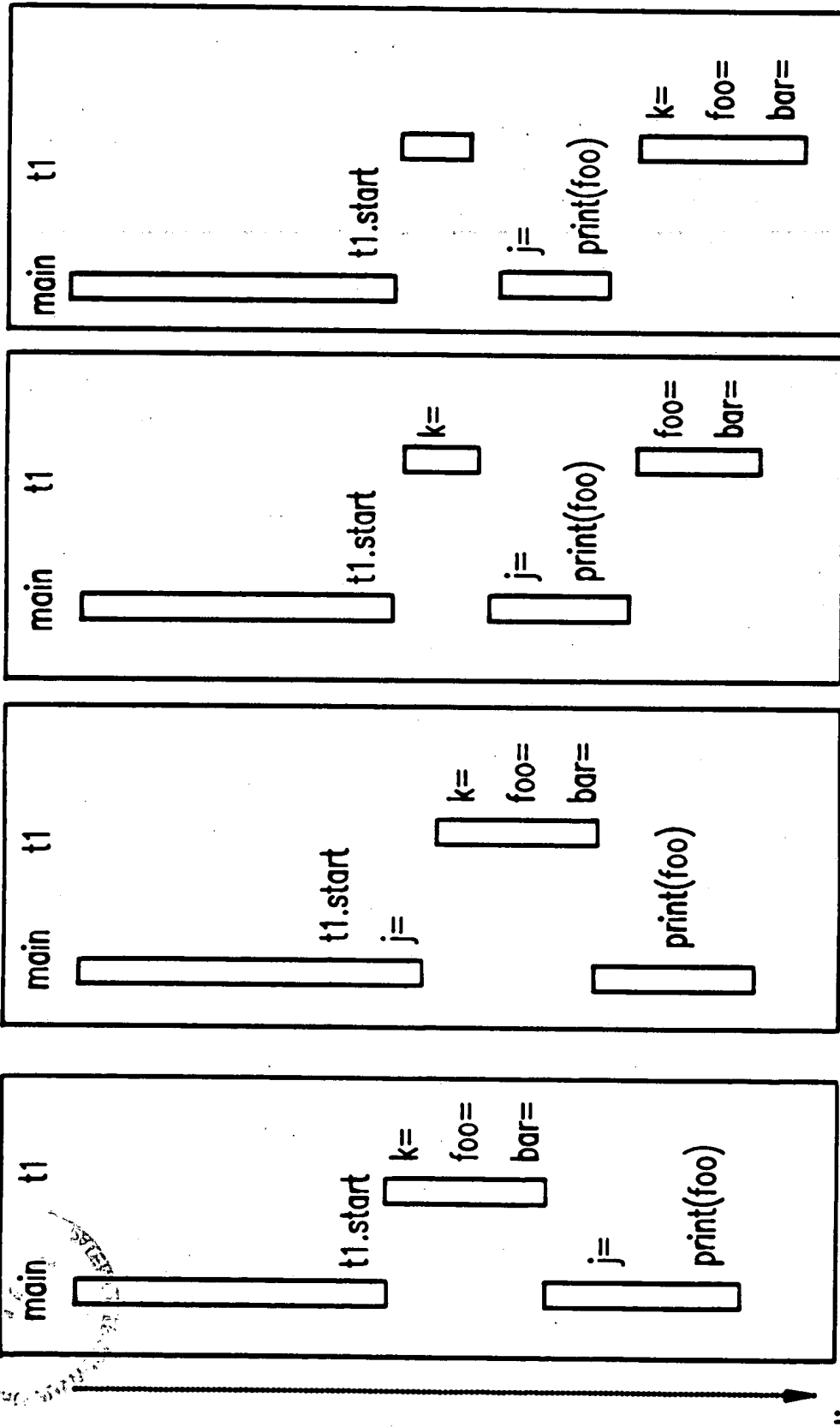


FIG.2(a)

FIG.2(b)

FIG.2(c)

FIG.2(d)

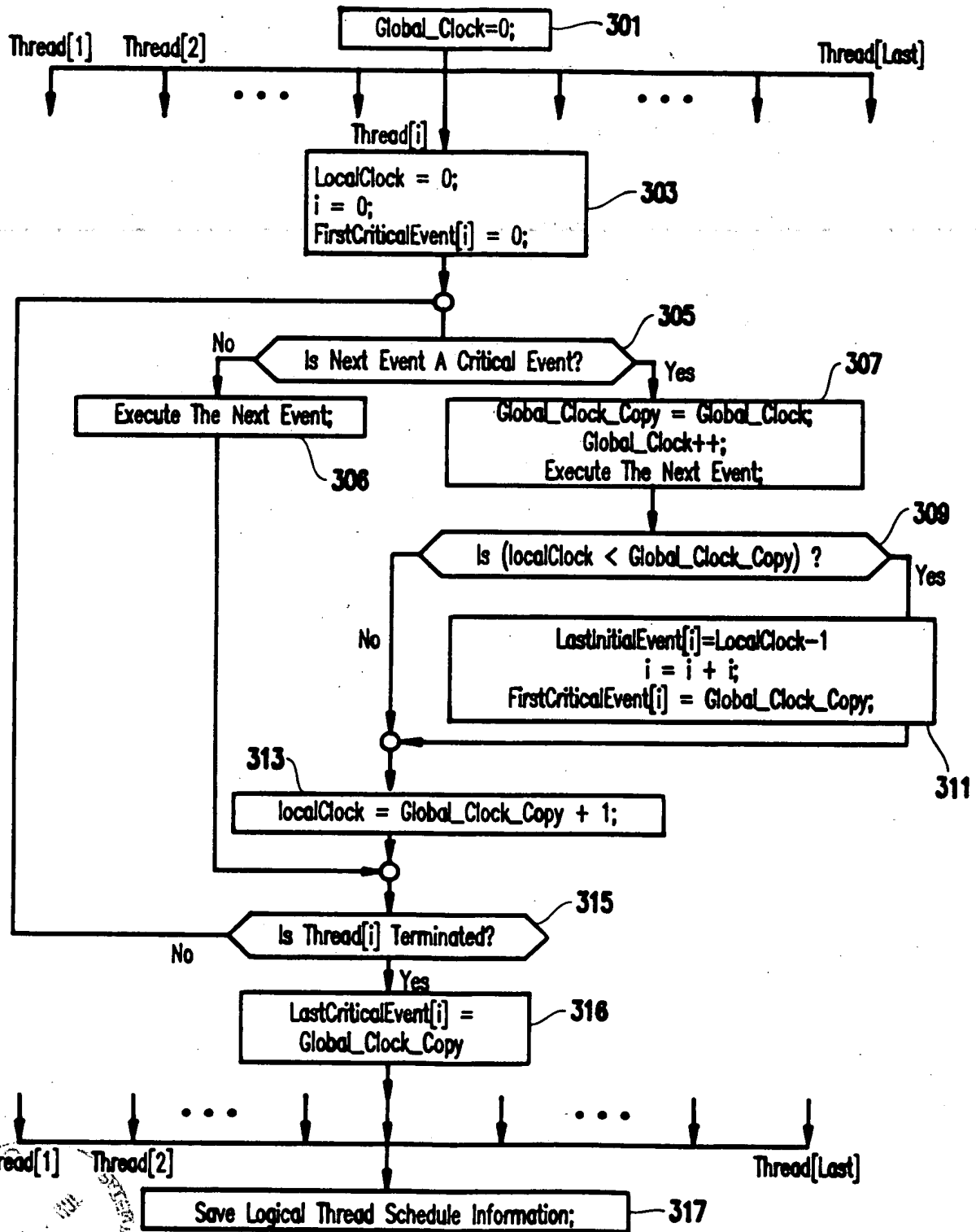


FIG.3(a)

FIG.3(b)

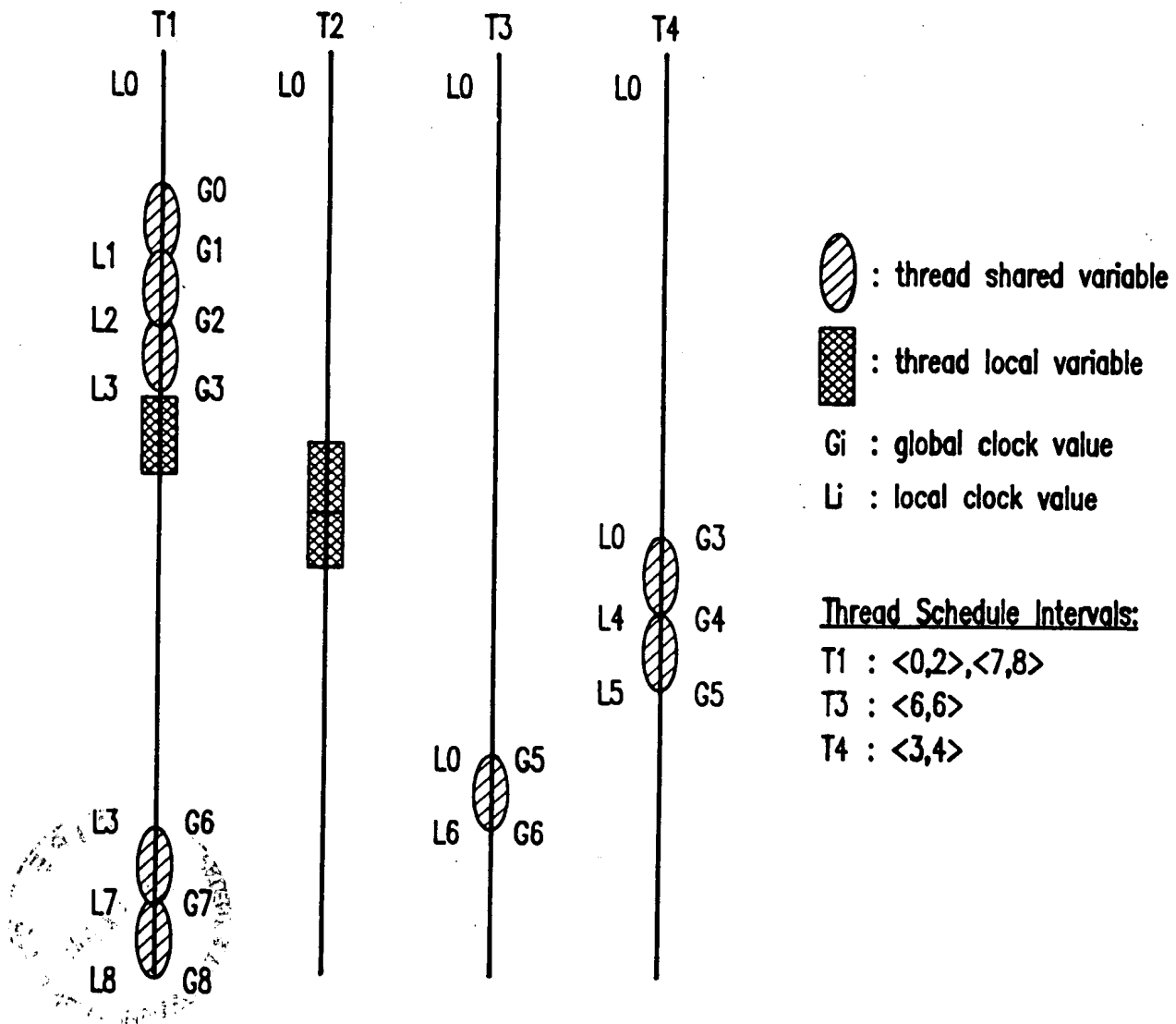
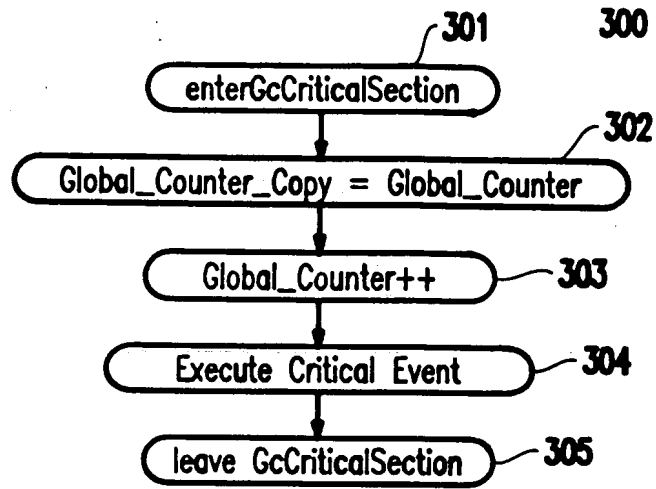
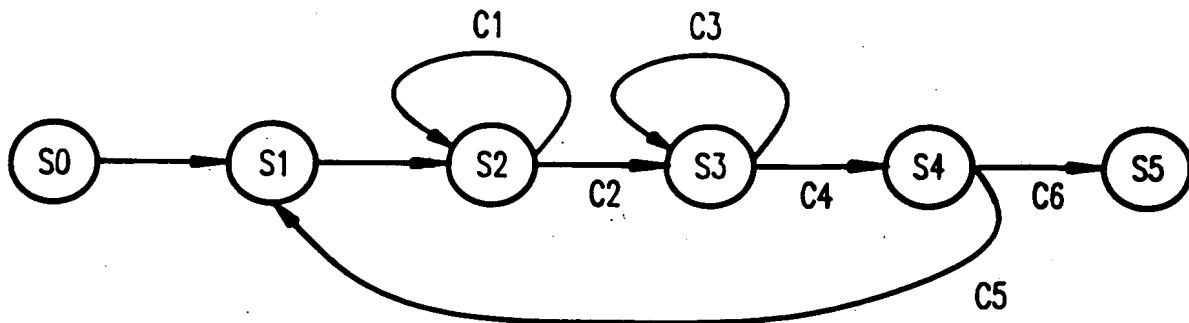


FIG.4



S0: START, $i = 0$
 S1: update FirstCriticalEvent(i) and
 LastCriticalEvent(i)
 S2: yield the thread schedule
 S3: execute event.
 if CriticalEvent increment global_counter
 S4: $i = i + 1$
 S5: END

C1: $\text{global_counter} < \text{FirstCriticalEvent}(i)$
 C2: not C1
 C3: $\text{global_counter} \leq \text{LastCriticalEvent}(i)$
 C4: not C3
 C5: $i \leq \text{last interval}$
 C6: not C5

FIG.5

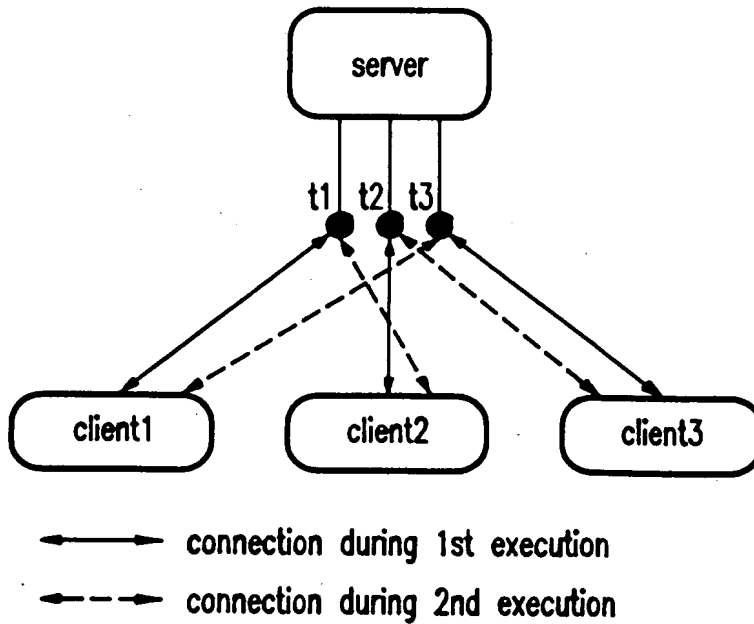
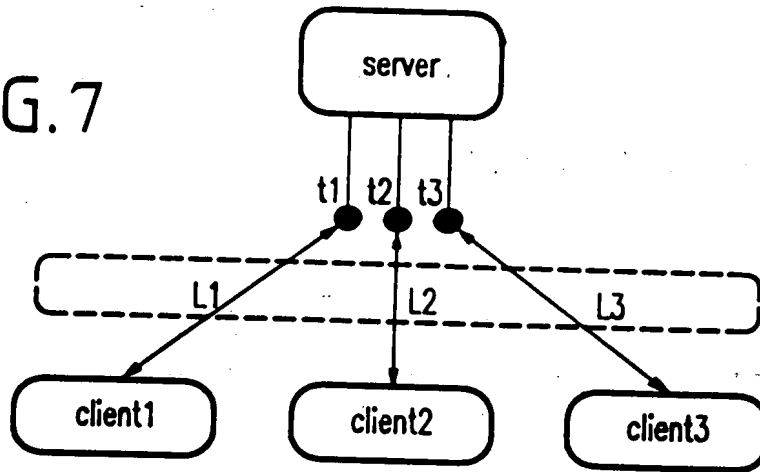


FIG.6



FIG. 7



L1: <gS1, Client1Id>, Client1Id = <Client1VMID, gCounterClient1>>
 L2: <gS2, Client2Id>, Client2Id = <Client2VMID, gCounterClient2>>
 L3: <gS3, Client3Id>, Client3Id = <Client3VMID, gCounterClient3>>

FIG. 8(a)

read in Record Mode

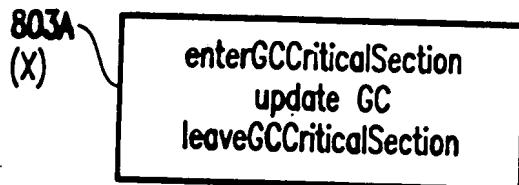
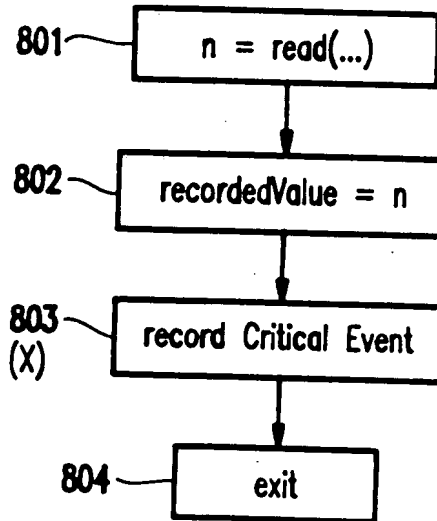


FIG.8(b)
read in Replay Mode

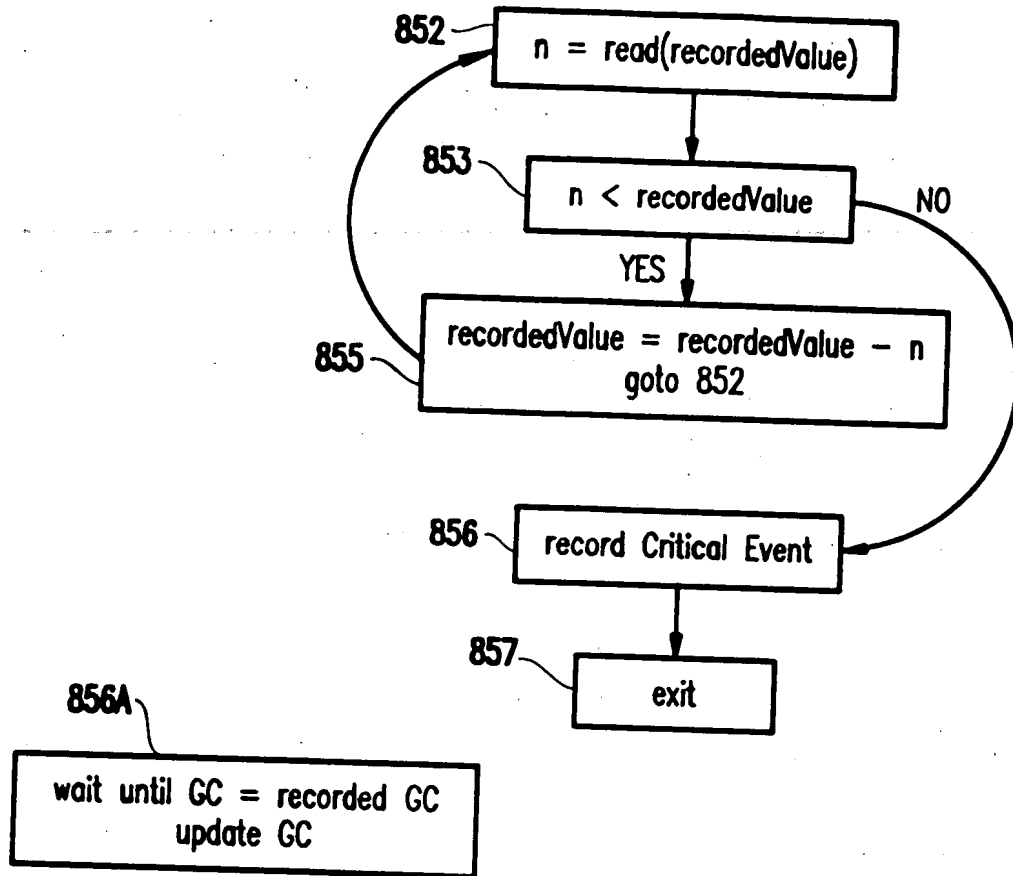


FIG.9(a)
write in Record Mode

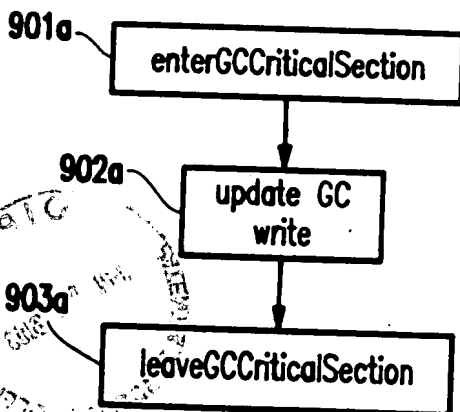


FIG.9(b)
write in Replay Mode

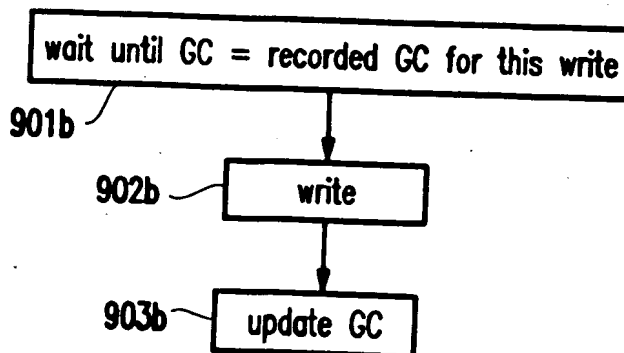


FIG.10
accept and connect in Record Mode

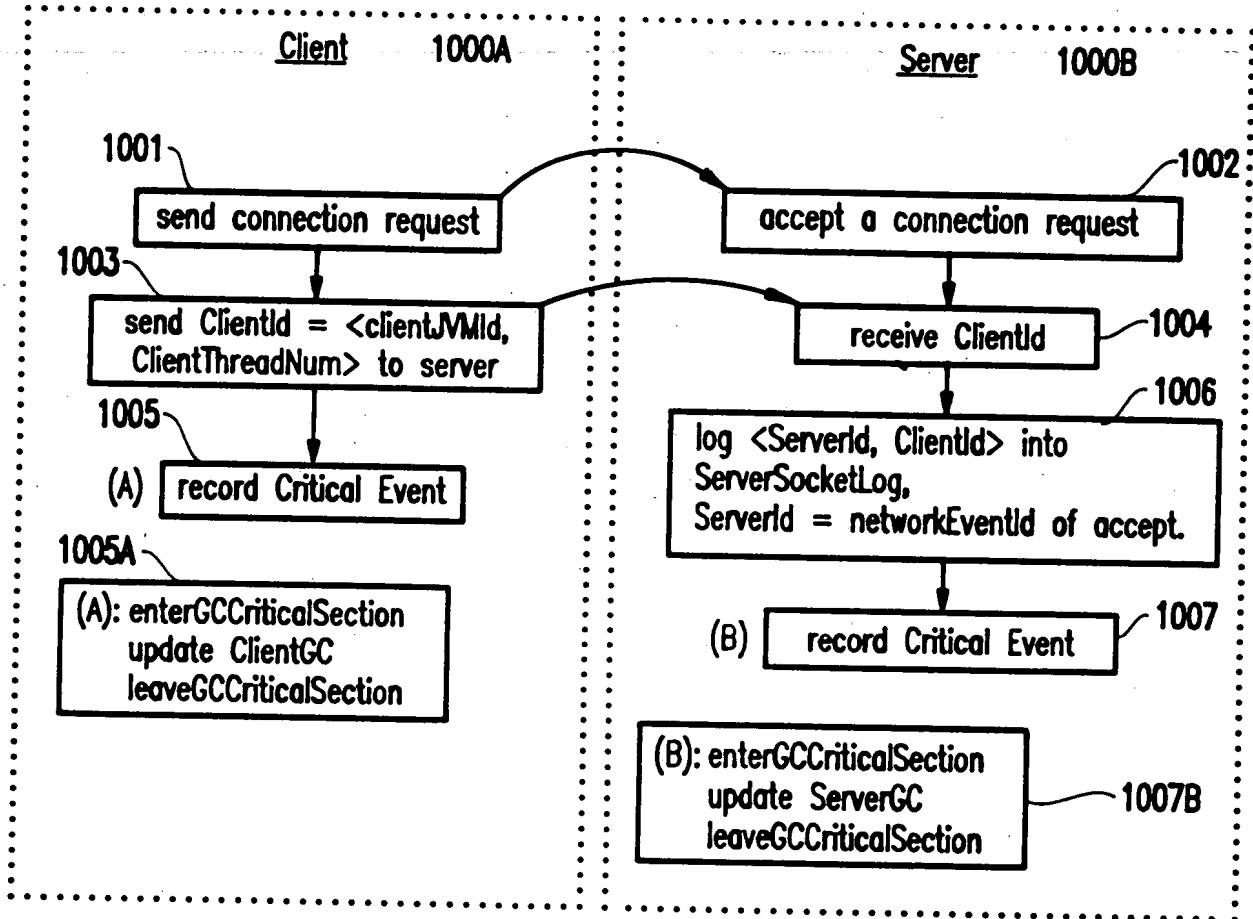


FIG. 11

accept in Replay Mode

Server

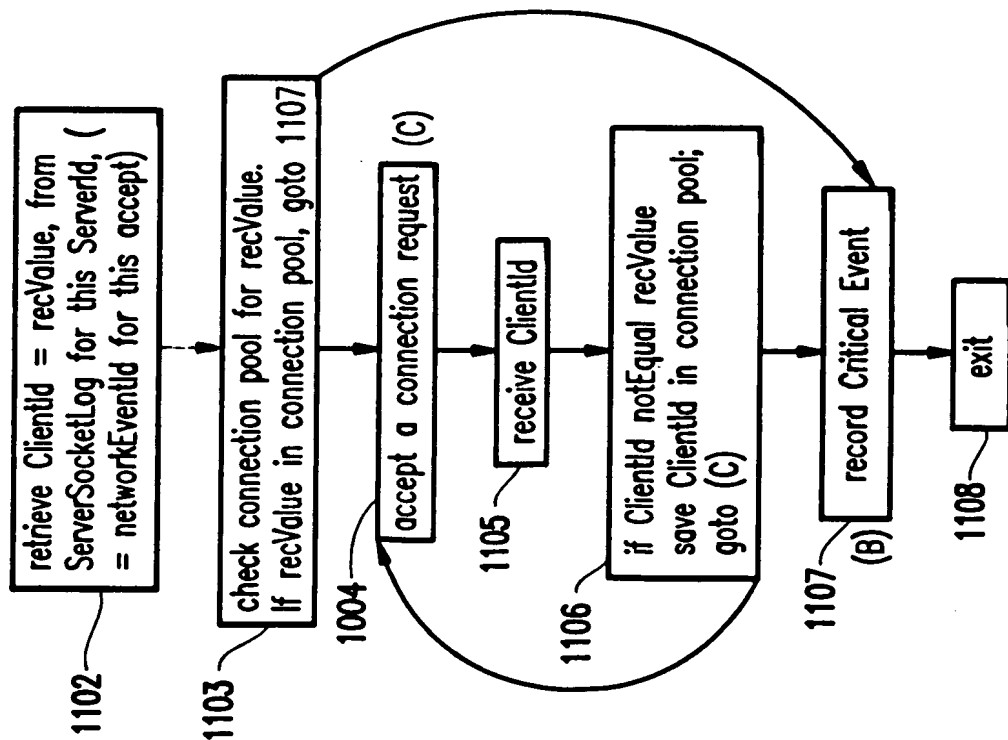


FIG. 12(a)

efficient replay of read

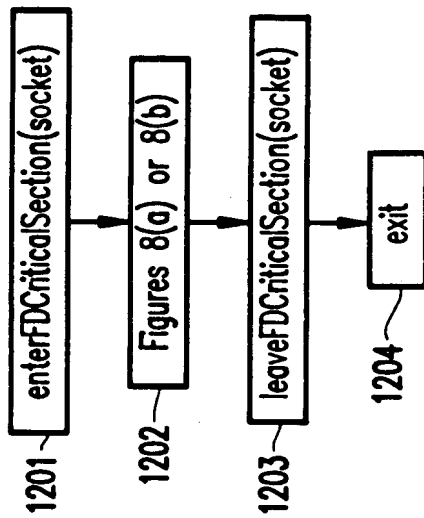


FIG. 12(b)

efficient replay of write

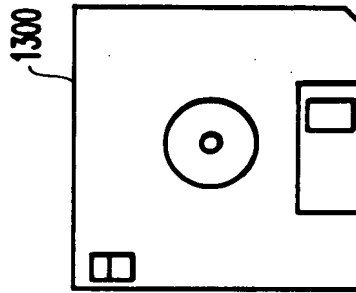
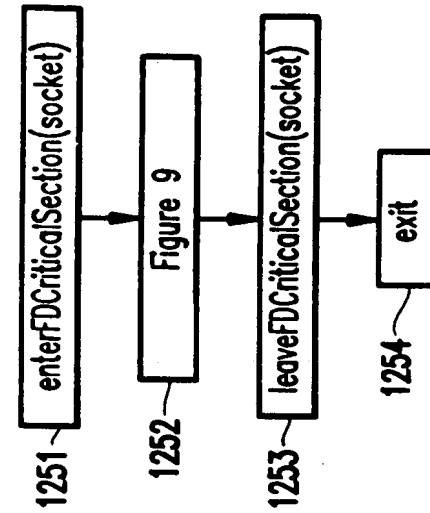


FIG. 13